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ABSTRACT

The materials in this educational packet are designed for use with students in grades 4 through 7. They consist of a leader overview, teaching guides and student data sheets for three activities, and a poster. The leader overview describes the nature of beaches, dunes, and barrier islands, tracing their development, settlement, and management and emphasizing the mobile, dynamic nature of these habitats. A glossary and list of reference materials are included. The three activities are: (1) a transect study in which students are introduced to a beach's habitats, zones, movement, and problems; (2) an investigation of the adaptations necessary for survival on a beach; and (3) an exploration of human uses of beach, dune, and barrier island habitats. The teaching guides provide an introduction to and instructional strategies for the activities as well as a list of materials needed, a list of learning outcomes, and a student review sheet (with answers). The poster provides illustrations of the variety of beach wildlife and a simple key used as an aid in their identification. An additional activity on tidal tracks is also included as a separate "student page." (JN)

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Beaches, Dunes, and Barrier Islands

Habitat Pac

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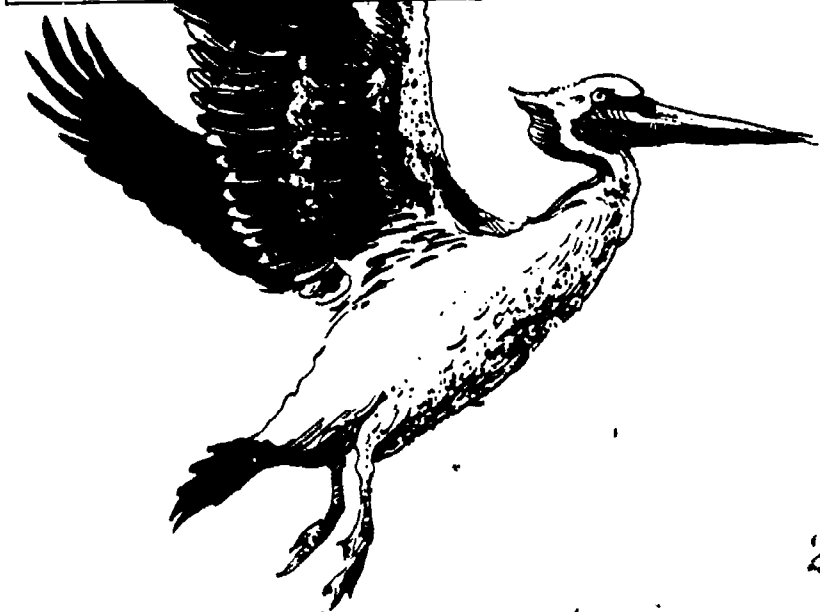
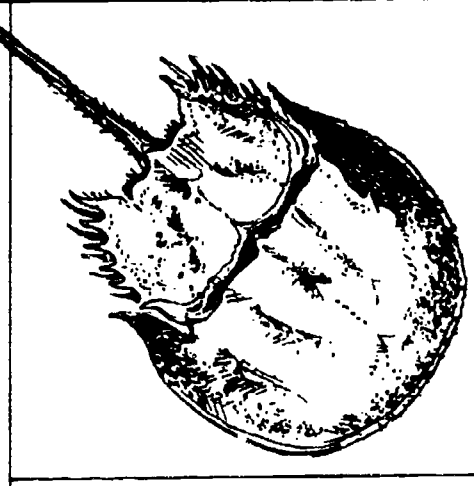
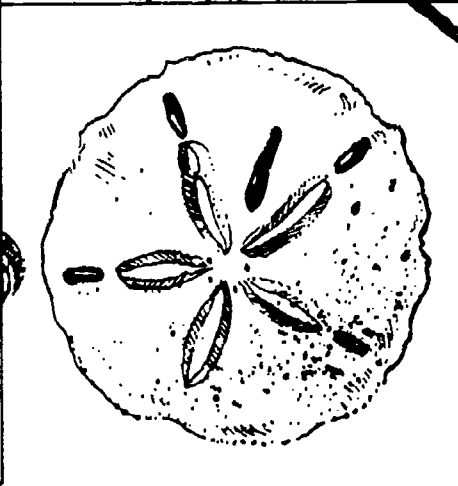
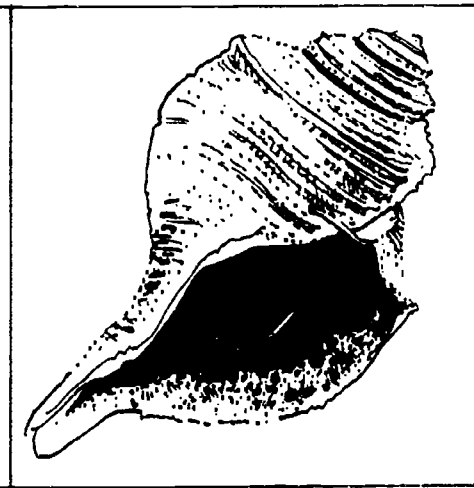


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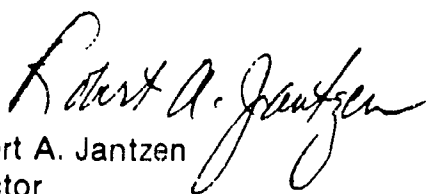
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This education package represents an important step in our efforts to provide teachers and other educators with factual information about wildlife, habitat, and resource management. We hope that you find these materials useful and that you will encourage your students to learn more about America's wildlife heritage.



Robert A. Jantzen
Director
U.S. Fish and Wildlife Service

These materials are designed for use with students in grades four through seven.

Leader Overview

As an introduction to beaches, dunes, and barrier islands, the Overview traces their development, settlement, and management while emphasizing the mobile, dynamic nature of these habitats. Boldfaced words are defined in the Glossary and reference materials are listed under Resources.

Poster: Side 1

By means of a quotation and illustrations the poster introduces students to the variety of beach wildlife. Use this poster to reinforce Activities 1 and 2.

Poster: Side 2

A simple picture key to the basic plants and animals of a typical beach, this side of the poster will be used by students as an aid to identification in Activities 1 and 2.

Student Pages: Tidal Tracks and Traces

Page 1 shows a picture of a beach in the early morning with wildlife tracks and marks. Using illustrations and descriptive verses on Page 2 students will match animals to their names and to the tracks they left on the beach.

Activity 1: Transect Study

This Activity provides a first-hand introduction to the ecology and inhabitants of a beach. Students will learn:

- The distribution of beach organisms into zones; and
- The variety of life that the habitat supports.

Activity 2: Adaptation Applications

The animal and plant adaptations necessary for survival on beaches will be demonstrated through this exercise. Also, the relationship between a habitat and its inhabitants will be explored. Students will learn:

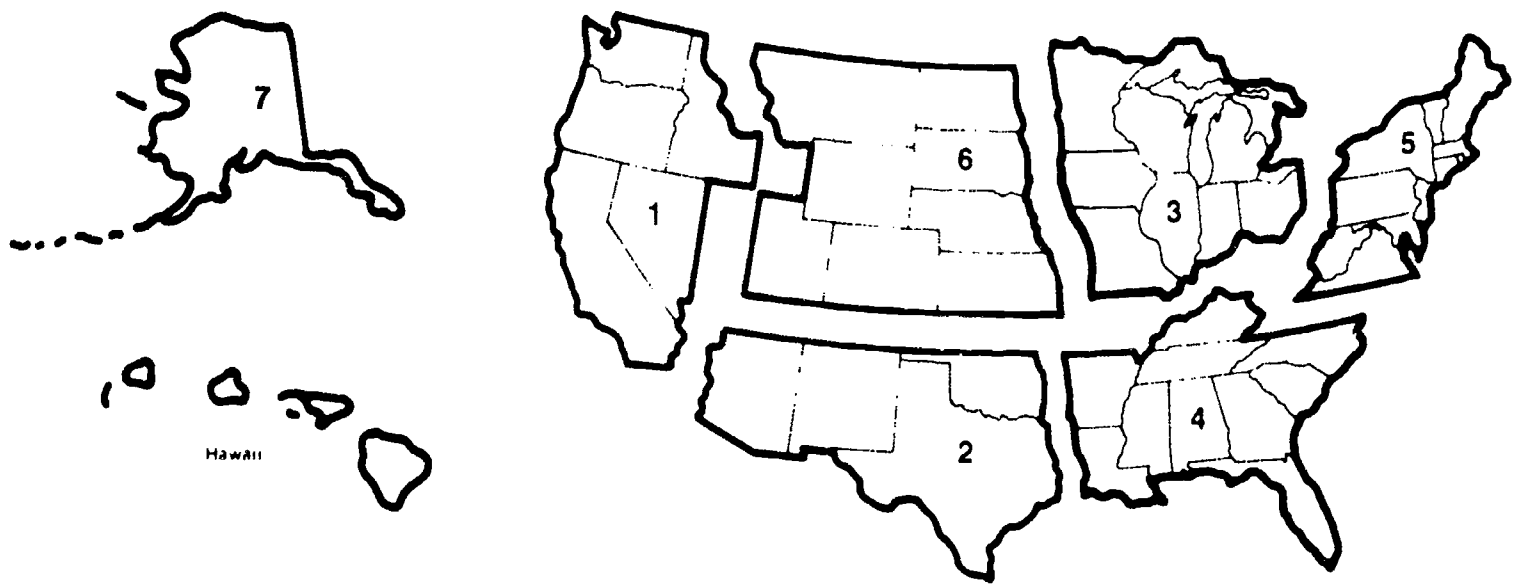
- How specific adaptations allow a species to survive on the beach; and
- How people might use natural adaptations to their advantage.

Activity 3: Seashore Survey

Beaches are used by people for many different purposes. Through a survey, students will determine differences and the reasons behind them. Students will learn:

- The variety of uses for a beach;
- The problems perceived by the users; and
- How a beach can be managed to ease these problems.

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The Institute is the only private national conservation organization with programs dealing almost exclusively with fish and wildlife in

urban and other disturbed areas. Funded through private and corporate contributions, grants and contracts, it is filling some of the glaring gaps in information and methodologies needed for the management and enjoyment of wildlife and wildlife habitats in urban areas.

The Institute accomplishes its mission by (1) conducting sound research on the relationship between man and wildlife under urban and urbanizing conditions; (2) discover-

ing and disseminating practical procedures for maintaining, enhancing or controlling certain wildlife species in urban areas; and (3) by building an appreciation for, and understanding of, wildlife and a positive conservation ethic at the local community and neighborhood level, and illustrating how all segments of our people have a vested interest in wildlife and the environment we mutually share.

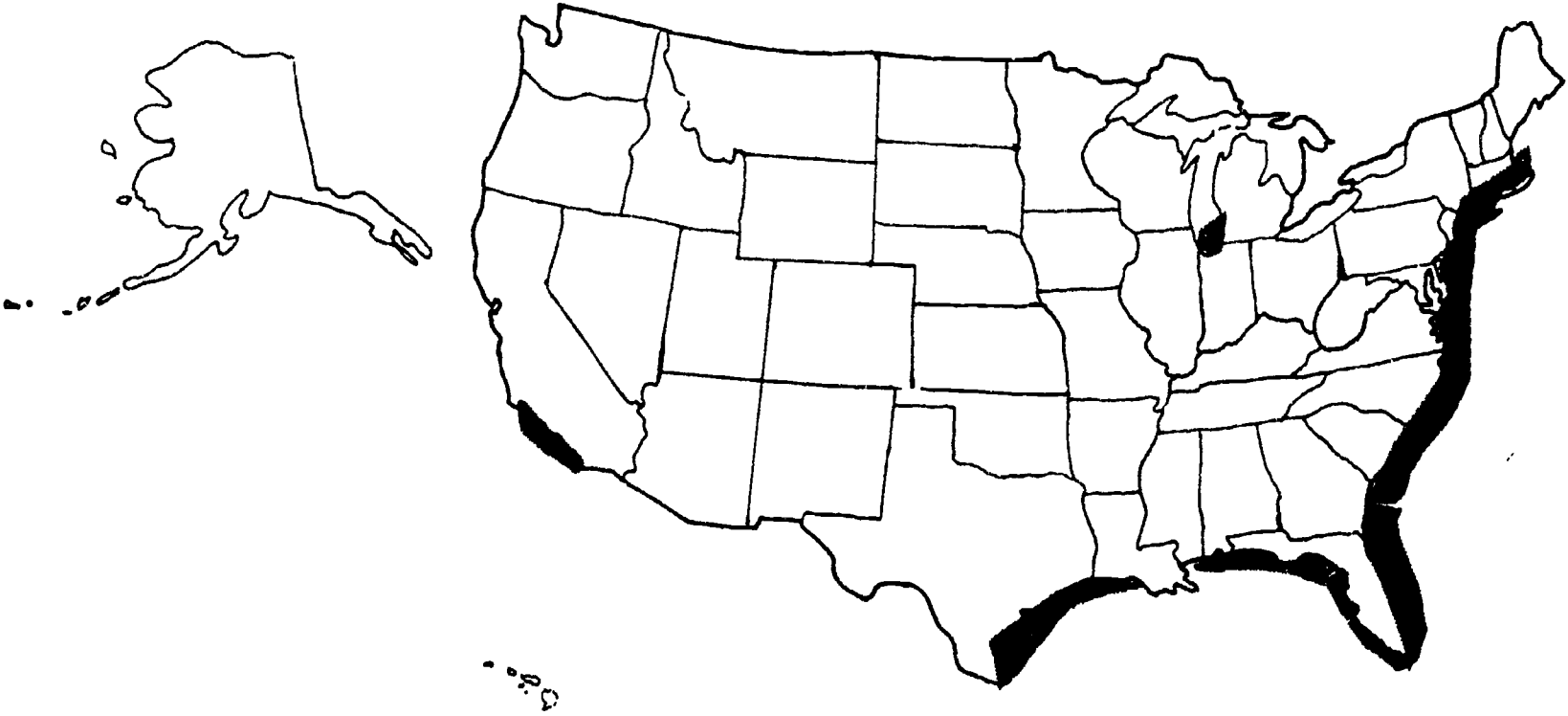


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Beaches, Dunes, and Barrier Islands of the United States

 Beach



Beaches, Dunes, and Barrier Islands

Leader Overview



Beaches, dunes, and barrier islands are seaside habitats in which natural elements move and shift causing constant change. In order to survive the dynamic forces of moving sand, wind, and waves, plants and animals must become highly adapted to their shoreline environment. Humans and many wildlife species use the habitats. Since few species can survive here year round, these uses are generally seasonal.

What are Beaches, Dunes, and Barrier Islands?

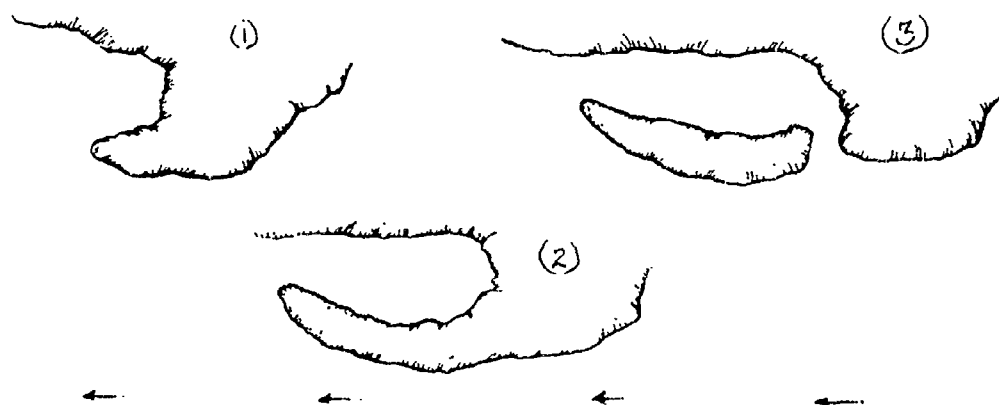
Beaches, dunes, and barrier islands are made of millions of particles of eroded rock called sand. Constantly washed by waves and currents, sand collects in huge deposits between land and oceans. These deposits, called beaches, can be found on both the mainland and barrier islands—lands which have become separated from the mainland. Large hills called dunes are located behind beaches, and are formed from sand carried by wind.

Due to its relatively young geological age, the West Coast has a more rocky (less sandy) coast with few sandy beaches. Most beaches, dunes, and barrier islands of the United States are located on the East and Gulf coasts, but many beaches and dunes are found in the Great Lakes region, particularly on the shores of Lake Michigan.

Often beaches, dunes, and barrier islands are found in the same general area. For instance, a barrier island may have a beach front with dunes behind. Directly behind this may be a narrow channel

separating the island from the mainland. In this channel, a wetland marsh may develop which supports a wide variety of plants, fish, and other wildlife. This change occurs because the beaches, dunes, and barrier island itself form a buffer zone, which traps sand and deflects water. The channel is therefore protected from the high winds and eroding forces of the coast and can develop into a marsh.

Change, both gradual and sudden, typifies beach, dune, and barrier island habitats. The ocean's tides and currents deposit or carry off sand caus-



Barrier island breaking away from mainland

ing beaches to expand or contract with time. Unstabilized dunes move with the winds and can bury entire salt marshes and forests. Barrier islands can be created or destroyed by floods, storms, and erosion. This perpetual change results in an extremely dynamic, mobile habitat.

Plant Life

Deep, penetrating roots, an ability to grow rapidly, and mechanisms to excrete excessive salt and tolerate submersion in saline water allow American beachgrass (in the North) and sea oats (in the South) to grow on the beaches, dunes, and barrier islands. These are the first grasses to appear on dunes, and their roots fix the sand in place.

As a dune is stabilized by grass, other plant species begin to grow there and on the surrounding beach. Shore rush, seaside goldenrod, railroad vine, holly, sedge, beach plum, wax myrtle, sea grape, pitch-pine, and sassafras are common dune and shore vegetation found on the Gulf and East Coasts. Lupine, sea fig, beach pea, sand strawberry, bayberry, beach morning glory, seaside daisy, and sand verbena appear on shores of the West Coast. Trees grow on the older dunes set far from the beach, protected from the effects of wind, salt spray, and salt water. These trees include oaks, pines, palmettos, and cedars.



Beachgrass and goldenrod

Beach Animals

The animals living directly on the shore (the strip of beach between high and low tide marks) include a variety of worms, **crustaceans**, and **mollusks**, each adapted to the hazards of the environment. Animal adaptations include burrowing beneath the sand, clinging to rocks, and growing hard, protective shells. Each of these provides the animal with a way of stabilizing itself in an unstable environment.

Some worms, ghost shrimp, and various crabs dig holes beneath the sand, obtaining their food when the sea rushes over their burrows.

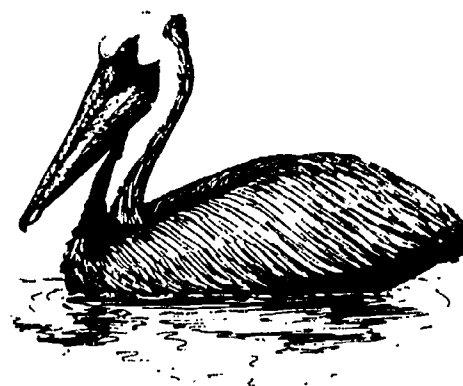
Barnacles and other **invertebrates** withstand wind and wave by clinging to rocks, driftwood, or any other relatively "permanent" feature of the beach. They feed on the **plankton** washed in with tides.



Barnacles on rock

Mollusks are covered in hard, protective shells, and can thus survive the harshness of the sand and surf. Shells also protect the animal from predators. Shelled mollusks include clams, oysters, and scallops.

Crustaceans too have hard shells which they shed and replace as they grow. Unlike mollusks, they have legs and can either crawl or swim. Crustaceans, including crabs, shrimps, and lobsters, are found in the water, on the shore, and in intertidal pools.



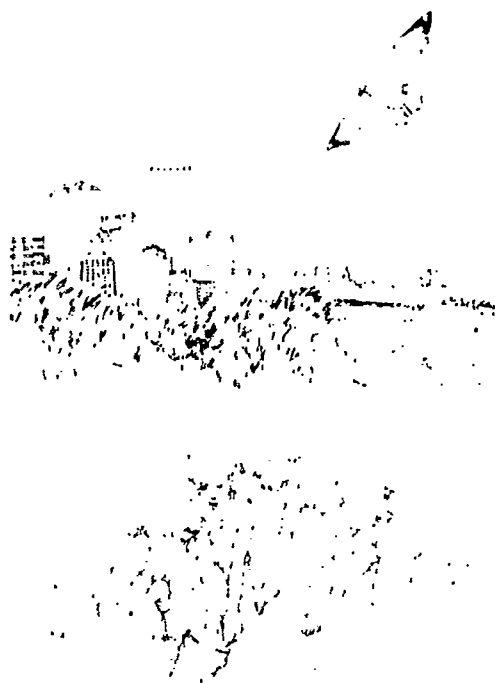
Brown pelican

Barrier islands and the marshes behind them often serve as stop-over sites for birds, such as sandpipers, pelicans, herons, and gulls.

A variety of reptiles and mammals use beaches as a breeding and/or feeding ground. For instance, several kinds of sea turtles lay eggs on the beach. Predatory species using the habitat includes snakes, raccoons, foxes, and skunks. Like humans, these animals feed on fish, crabs, shrimps, oysters, barnacles, clams, turtle eggs, etc.

People, Beaches, and Barrier Islands

Before modern development made it possible for humans to live year-round on beaches, dunes, and barrier islands, people made cautious, limited use of the habitat. However, by the late 19th century, travel and building methods had improved. Railroads and bridges made beaches available for tourism, and hunt clubs and resort hotels began to appear. Permanent settlements grew, as did the ever increasing flow of vacation traffic. Some of the barrier islands settled and developed in the 19th and 20th centuries include Fire Island, Cape Hatteras, the Florida Keys, and Galveston Island.



However, people who settle on a beach or barrier island are faced with the possible destruction of their homes and livelihood by the sea and the weather. Violent storms are common in the Gulf area, as are "northeasters" along the Atlantic coast. These storms have caused flooding, sand upheaval, and washing away of homes, roads, and lighthouses. Evacuation of many barrier islands is difficult because bridges are easily flooded and

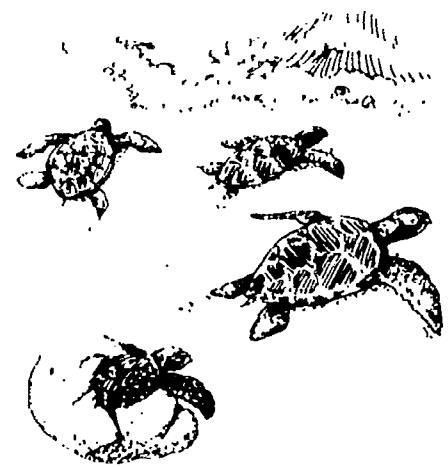
boats are unable to navigate during storms.

Erosion is also a problem. The daily loss of sand can eventually result in a loss of beach front. Erosive forces act on the metal, wood, and brick that make human dwellings. Building foundations are eaten away by constant surf action and structures collapse. It is estimated that \$300 million in property loss occurs annually on barrier islands.

To avoid beach erosion people have built **jetties** and **groins** to trap sand, a solution that presents its own set of problems. One beach may be saved, but another farther down the coast may disappear when incoming sand supplies decline.

The dynamic nature of the beach is altered by more than jetties and groins, however. Developers level dunes for building sites. Loss of the protective aspects of dunes means that marshes and estuaries are vulnerable to the movements of sand and can be destroyed or degraded along with their inhabitants. People walk and drive on remaining dunes. This kills the plants stabilizing the dunes and frees the sand to blow about, changing the stability, size, and function of the habitat. Dunes are important in dissipating storm energy by blocking winds and waves. When dunes are destroyed, storms can destroy the developments built on a beach.

Thirty-four endangered and threatened species, including



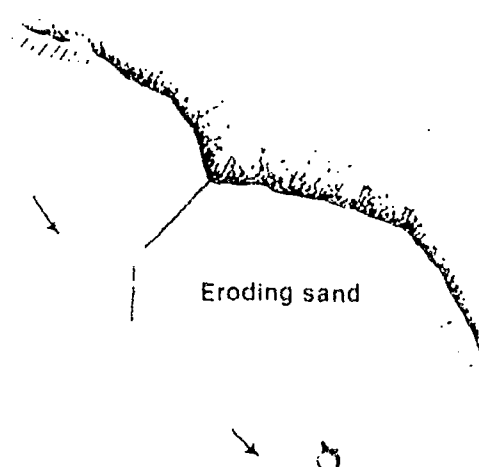
Loggerhead sea turtle hatchlings

the whooping crane, bald eagle, eastern brown pelican, peregrine falcon, and loggerhead sea turtle rely on beaches, dunes, and barrier islands. Some of these species have lost their feeding and nesting sites to development. Some are harmed by pollution of the ocean. Others, such as young loggerhead sea turtles, are often run over by cars.

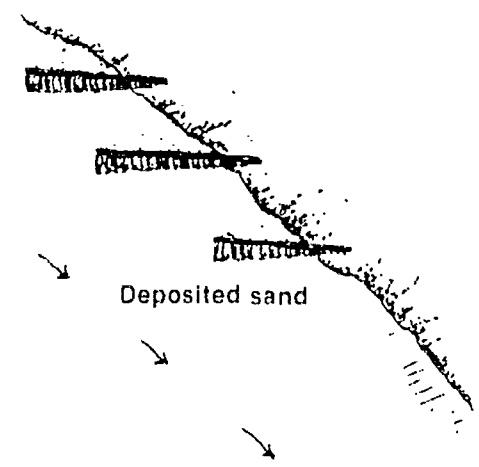
Future of Beaches, Dunes, and Barrier Islands

Barrier islands, beaches, and dunes have been under assault by wind and wave for millions of years. Coastlines have retreated and advanced. Dunes are leveled and reformed. Barrier islands are formed and obliterated. No structure near the sea can be truly permanent. The species dependent on barrier islands have become adapted to sudden changes, hiding underground from overhead threats, or retreating with the shore. These species have either retained as much mobility as

Jetty



Groin



possible or provided their own stability in an everchanging environment. Humans bring a false sense of stability to beaches, dunes, and barrier islands. Natural balances are altered, often with unforeseen and negative effects on wildlife and on humans trying to control the environment.

Some human occupants of barrier islands are trying to balance their enjoyment of this habitat with the natural dynamics of the coast. Driving on many dunes is controlled, and boardwalks are built to channel pedestrian traffic.

A variety of conservation organizations and agencies are working to insure that the abundant wildlife and scenic beauty of beaches, dunes, and barrier islands will remain available for future generations. The Nature Conservancy, a private organization, owns and manages several barrier islands along the Virginia coast. On Assateague Island, two Federal agencies plus the Maryland State Park System work together to provide recreation for people and habitat for wildlife which includes the famous Chincoteague ponies. Management techniques include allowing the shore to move freely as dictated by the sea.

In addition, the value of these habitats is becoming better known. The effects of human actions are being extensively studied and carefully planned. The analysis of alternatives is now recognized as an important consideration before development.

Glossary

barrier island—Long, narrow islands made of moving sands; usually parallel to the mainland coast; protects coast from winds, waves, etc.

beach—Sandy strips of land forming the shoreline of oceans or lakes.

crustacean—A mostly aquatic invertebrate, typically having a hard shell, legs, and often claws; includes lobsters, shrimps, crabs, and barnacles.

dune—A hill or ridge of sand forming a protective barrier. Created by wind, dunes are commonly found along shores of oceans and large lakes where sand is dry during some part of the year.

groin—Breakwater structure constructed outward into the water to reduce sand transport from a beach.

invertebrate—Animal without a backbone.

jetty—Structure projecting into the water to protect a harbor from waves or to redirect a current.

mollusk—Invertebrate, usually with a hard shell; includes clams, oysters, snails, mussels, and scallops.

plankton—Microscopic free-floating plants and animals found in water.

sand—Tiny grains of rock, usually quartz.

Resources

General Reference

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The Sea Beach at Ebb Tide, Augusta F. Arnold. Dover Publications, New York, 1963.
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Seashore, David Lampert. Watts, New York, 1978.

Seashores: A Guide to Animals and Plants Along the Beach, Herbert Zim and Lester Ingle. Golden Press, New York, 1955.

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The Atlantic's Last Frontier—The Virginia Barrier Islands. The Nature Conservancy, Arlington, VA, 1979.

Birds of Shore and Marsh. Coronet Instructional Media, Chicago, 1974.

It's Your Coast. Motion Picture Service, Department of Commerce-NOAA, Rockville, MD, 1976.

Beaches, Dunes, and Barrier Islands

Activity 1

Transect Study

Purpose

Students will be introduced to a beach's inhabitants, zones, movement, and problems by recording information gathered in a transect study.

Learning Outcomes

After completing this Activity, students will be able to:

- A.** Correctly name general types of beach wildlife such as clams, crabs, and sandpipers.
- B.** List and group beach wildlife into zones according to their distribution.
- C.** Record signs of humans and label these signs as having either positive or negative effects on beach wildlife.
- D.** Define "indicator species" and state how ghost crabs and beach heath serve as indicators of how much use an area receives.

Organization

Who: Students working in small groups

Where: Beach, dune, and/or barrier island

When: Any season, during low tide

Time: Two to three hour field trip, one hour indoor followup

Safety: **a.** This lesson should be conducted during an outgoing tide. **b.** Students should be organized into buddy pairs and, if they enter the water, should not go farther than ankle deep. Arrange for adequate supervision near water (at least one adult per ten students). **c.** Warn students against going barefoot. **d.** Take proper sunburn precautions.

Materials: For Each Group

- Data Sheets
- Clipboards (Masonite or stiff cardboard with a paper clip or binder clip)
- Pencils
- Sketch paper
- Magnifying glass
- Measuring tape or some other device to measure transect intervals
- Copies of second side of poster
- Five stakes, each one-half meter (two feet) long
- Old clothes and shoes

Directions

1. Prepare your students for the field trip by discussing the geological and biological features of a beach habitat. Introduce them to the forces that shape the shore (wind and water) and the structures that result, including dunes and barrier islands. Stress that the dune habitat is fragile and vulnerable to erosion when climbed on.

2. Tell students they will be making a transect study of a beach to see the nature of the habitat and its inhabitants. A transect study is an investigation of an area along a straight line to see the changes that occur. Explain that plants and wildlife exist over different parts of a given habitat, depending on their needs and adaptations. Use the second side of the poster to illustrate some typical classes of organisms and where they might be found. Point out that students should observe the plant life without disrupting it and replace any animals they study once they are finished with them.



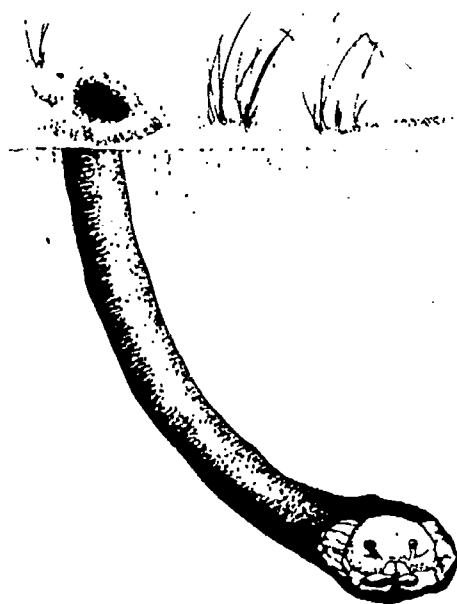
Hermit crab

3. Have the students wear old clothes and shoes that can get wet. (Suggest that they bring dry clothes to change into.)

4. At the field trip site, each group will make a transect study by making observations and recording data at regular intervals along a line from the edge of the water, up the shore, and to the dunes.

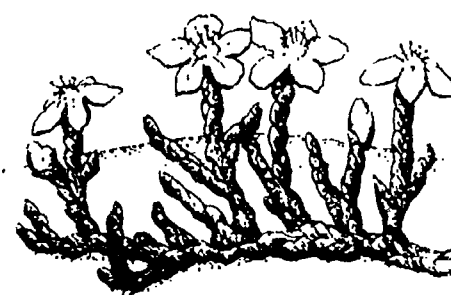
5. Divide the class into three groups. Each group will study along a separate line. Choose three areas on the beach: one area that seems heavily used by people, one that seems less heavily used, and a third that seems little used. Station groups at each of these areas to set up their transect lines. The sampling intervals along the transect lines are determined by the width and slope of the beach. For a very wide, gently sloping beach, observations could be recorded at 20-meter (22-yard) intervals. On a narrower beach, 10-meter (11-yard) intervals would be sufficient. There should be five recording stations between the water's edge and the dune system. As various forms of beach life are found in different zones of the beach, the intervals given should allow students to see some diversity of wildlife.

6. Beginning at the shoreline, have each group mark its starting point with a stake. At this and subsequent sampling points students will record the appropriate observations on their Data Sheets. Any organisms found should be identified (using the poster as a field guide), or sketched for later identification in the classroom. Evidence of human presence should be recorded. Using magnifying glasses, students may examine sand grains for texture and composition. Students may collect shells, pieces of driftwood, and discarded crab shells. Set a limit to their collections as these items form part of the shore scene.



Ghost crab and its burrow

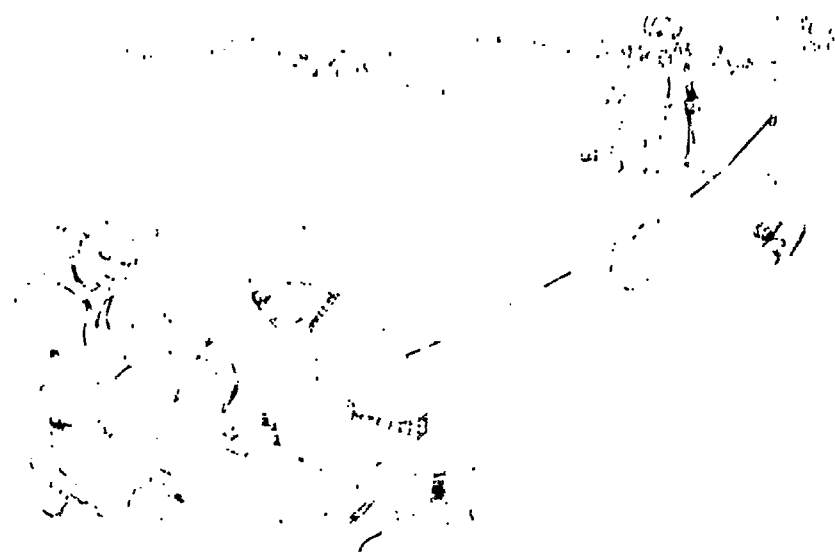
7. Special observations should be made of ghost crab holes and the presence of beach heath along the transect lines. Ghost crabs and beach heath are "indicator species" and can be used to show the impact of humans on the habitat. They are found more abundantly in areas little used by people.



Beach heath

Found on broad beaches from Massachusetts to Brazil, ghost crabs live in burrows dug near or well above the high-tide mark. They are most active at night, spending days in their holes except for an occasional necessary trip to the water to wet their gills. During the winter, ghost crabs hibernate under the sand, plugging off the entrances to their burrows.

Beach heath, also known as false heather, is a low growing shrubby plant with small yellow flowers that appear in late spring and summer. While well adapted to grow in dunes and sandy areas, beach heath is sensitive to disturbances such as being driven or walked upon. Beach heath can be found on the Atlantic Coast from Maine to North Carolina, and on the dunes of the Great Lakes region.



Transect study on little used beach

8. Continuing along the transect, the groups will locate the next sampling point. The interval should be measured out in line with the starting point and perpendicular to the water's edge. Have students mark this point with a stake and record their observations on their Data Sheets.

9. Back in the classroom, have each group list the organisms they found at each point. Compare these lists between groups and compile a master list for the class. Find what is common to all lists and all sampling points. Some species will be restricted to certain areas. Discuss reasons for this, such as how close to the water they are, the type of ground material available for anchoring of roots, or the degree of wind to which they are subjected. Consider ways the organisms have adapted to these features.

10. Ask students to use field guides to identify any shells, egg cases, etc. which they collected. Where do the students think these came from? Some are the remains of mollusks which lived on the beach, some are washed ashore from deeper water, and some are crab shells shed while growing.

11. Compare observations or evidence of human actions. Why do people use some parts of the beach more than others? The reasons may be due to location, regulations, or natural features. Use the findings on ghost crabs and beach heath to show how plants and wildlife react to the presence of people. Have the class list all the signs of human activity in the habitat and identify these as having positive or negative impacts on the plants and wildlife of the habitat.

Followup

On a beach, students can build a small "groin" (a structure projecting into the water to prevent sand erosion) from rocks to observe how humans attempt to control the movement of sand. By constructing a groin perpendicular to the shore, students can observe what happens to the sand on either side. Or they could build a jetty to protect a "bay" which they have dug out. Students could also visit an actual groin or jetty. In addition, aerial, time-sequenced photographs are available for students to see the effects over time of jetty or groin construction. What does this mean for people building on a beach?

In the classroom, students might make a collage display from the sketches of plants and wildlife they observed and any shells or driftwood they collected. As an alternate activity, these materials could be used to make a mobile or wind chimes.

Activity Review Answers

1. **a** — clams; **b** — crabs
2. **a**-1; **b**-2, 3; **c**-2, 3; **d**-3, 4.
3. People can harvest clams, etc.; frighten wildlife away; distribute food or garbage which attract gulls and other scavengers; disturb the dunes; and damage plant roots.
4. **c**. There are also indicator species which tell the extent of pollution, oil spill damage, and other disruptions of the environment.
5. **False**. Crab shells found on the beach are usually those cast off when shed during the growing process.

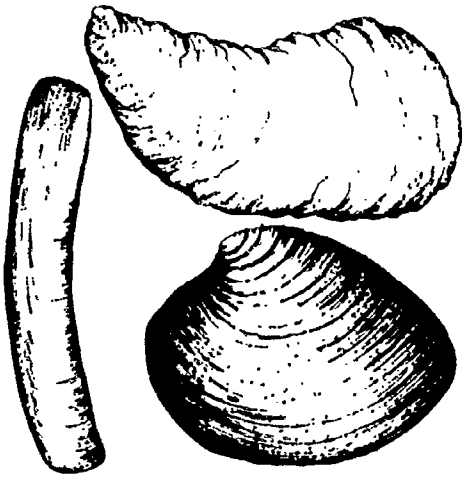
Beaches, Dunes, and Barrier Islands

Activity 1

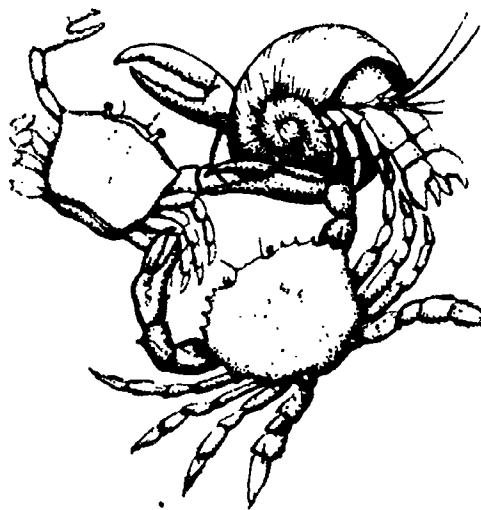
Activity Review

Name: _____

1. Label each of these groups with its general common name.



a. _____



b. _____

4. What information did the "indicator species" you studied provide? Circle the correct answer.

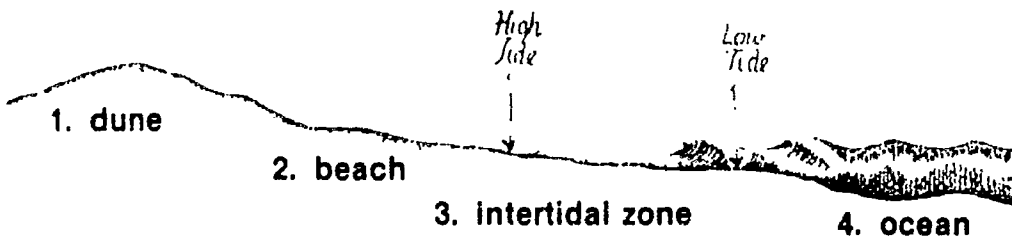
- a. Indicated location with bright color.
- b. Told when it last rained.
- c. Indicated whether people have used an area.
- d. Told what the animals that live on the beach like to eat.

5. The many empty crab shells on the shore show that there were once many more living organisms on the beach than there are now.

True or False?

2. Match the organisms listed below with the habitat shown in the illustration where they will be found.

- | | |
|--|-----------------------|
| ___ a. American beachgrass (or sea oats) | ___ c. Sand flea |
| ___ b. Sandpiper | ___ d. Horseshoe crab |



3. List three ways people can influence what lives on a beach.

- a. _____
- b. _____
- c. _____

Beaches, Dunes, and Barrier Islands

Activity 2

Adaptation Applications

Purpose

This Activity provides students with an understanding of the adaptations necessary to survive on a beach. Students observe natural adaptations and apply these observations to objects or "wildlife" they design themselves.

Learning Outcomes

After completing this Activity, students will be able to:

- A. List four adaptations of beach plants and animals.
- B. Demonstrate examples of these adaptations by creating a plant or animal that has them.
- C. Apply the natural adaptations they have observed to an artificial structure they will design and build.

Organization

Who: Groups of three or four

Where: Classroom

When: Any time of year

Time: Two to three hours

Materials: For the Class

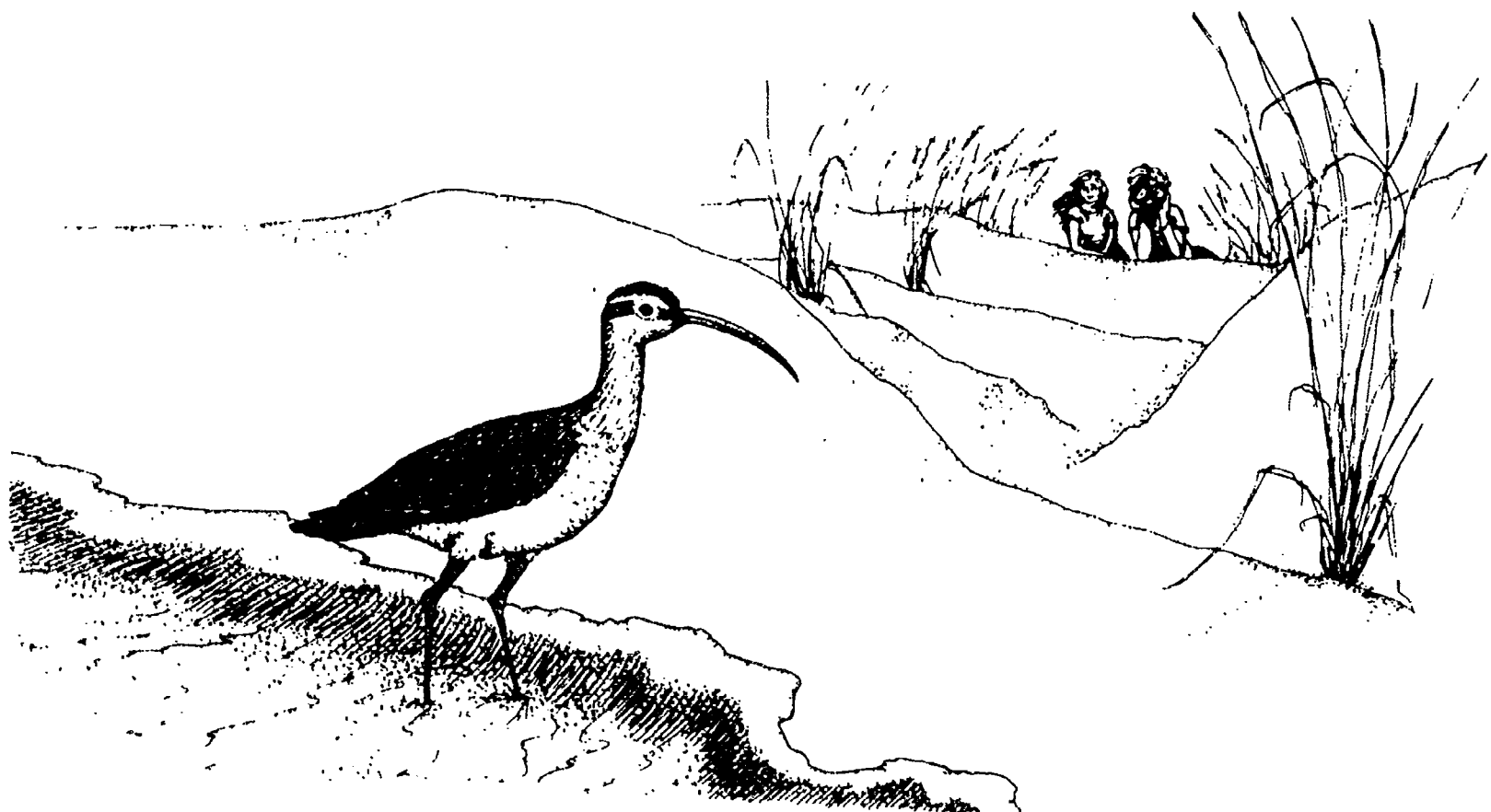
- Assorted creative materials—corks, balloons, pipe cleaners, feathers, construction paper, paints, scissors, glue, tape, etc.
- Field guides (see **Resources**)

Materials: For Each Student

- Data Sheets
- Pencil

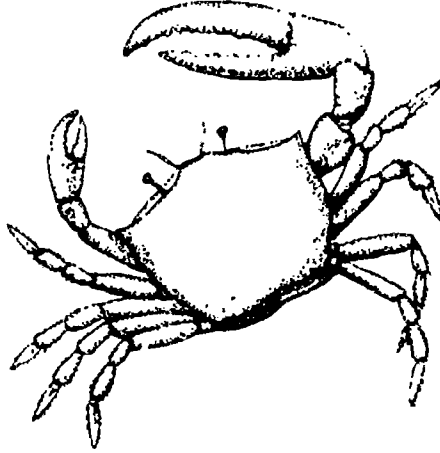
Directions

1. Using the illustrations on the second side of the poster, field guides, and their own observations and sketches, ask students to list ways that plants and animals have adapted to live on beaches, dunes, and barrier islands. These adaptations should include ways plants and wildlife can better obtain food and water, avoid predators, withstand ocean waves and currents, escape sand abrasion, and anchor themselves in a continually moving substrate. Write on the board the adaptive characteristics students generate.





Long legs and beak for feeding and wading



Claws and hard shell for protection



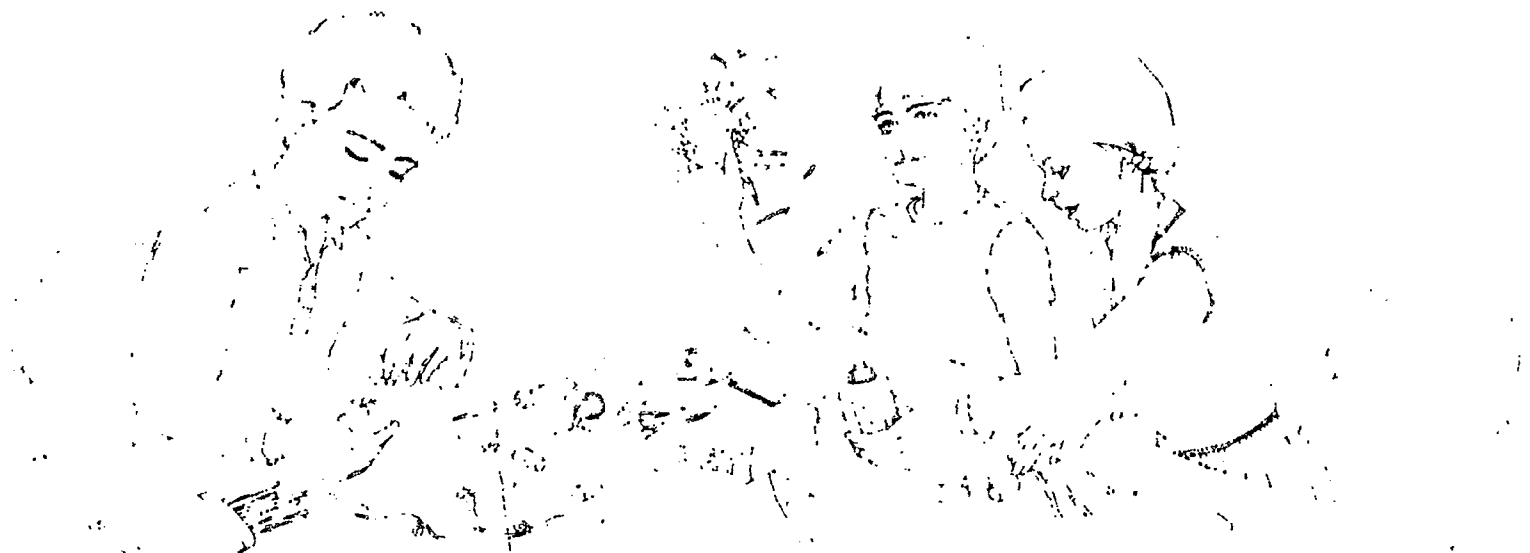
Spreading underground stems for stability

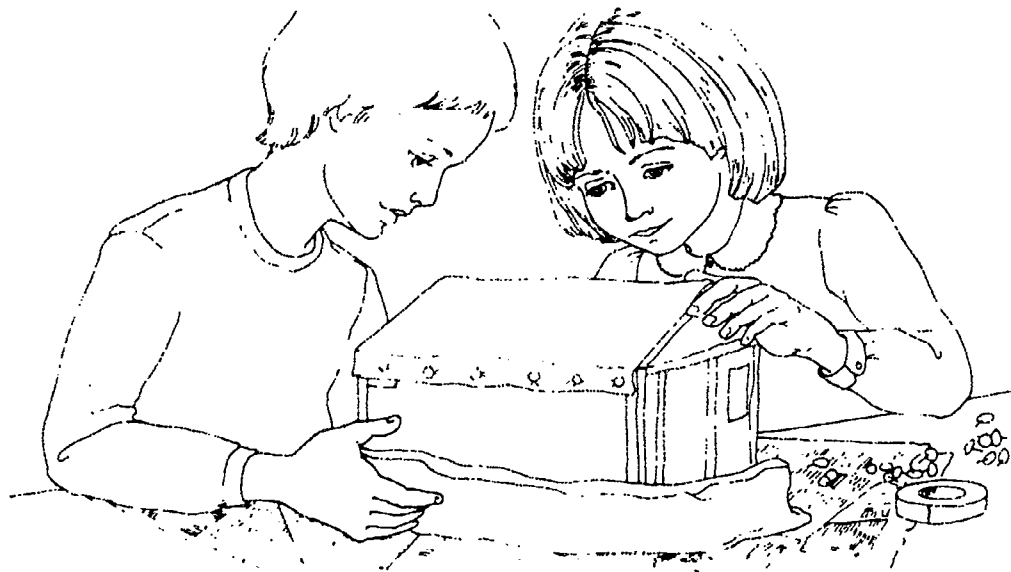
2. Once the list is produced, ask students, working in groups of three or four, to apply one or more of these adaptations to a plant or animal of their imagination. Provide a variety of creative materials—paints, clay, construction paper, toothpicks, string, pipe cleaners—whatever is available.

3. These imaginary organisms will then be presented to the class. In an informal oral report, the creature's habitat and adaptations will be explained by the group that created it. The class will then evaluate the creation, marking their Data Sheets with an adaptation evaluation score (see Data Sheet for instructions). These scores will be totaled and the overall score exhibited with the creature.

4. Students, again working in groups of three or four, will next apply the same techniques to build a house or other structure that would use these beach-suited adaptations. This building would be designed to take advantage of the beach habitat and allow for the hazards while having the least impact on it. Tell students to consider that metals are rusted by salt spray, wood is vulnerable to rot and tunneling worms, glass can be scratched by blowing sand grains, and sand under foundations can erode. Ways they might avoid these problems could include a plastic covering to be shed as the building ages, coating wood with rubber, or adding outlying structures to deflect wind and sand.

5. These structures are then to be presented to the class along with an explanation of their design. The class may ask questions and challenge the "architects" about the feasibility of the building. Based on this discussion and the Data Sheets, students will again give the creation an adaptation evaluation score. The total class score for each design will be recorded and displayed.





6. Discuss with the class how plants and animals have adapted to their habitats. For example, a barnacle attaches to a rock or pier by secreting a cement, sandpipers have long slender bills used to probe for small crustaceans and worms, and beachgrass spreads mainly through underground stems rather than seeds. Discuss the class' difficulties in designing a building that would meet the challenges of beach existence as effectively as wildlife adaptations. How do their highest-scoring created items compare with what really exists? Discuss whether or not the building ideas are practical.

Followup

Point out the number of large cities (Galveston, Miami, etc.) that are built on beaches. Have students consider their own ability to adapt. Ask the class to compare the structures they devised with what they have observed on an actual beach. Ask them to explain differences they note.

Activity Review Answers

1. Many adaptations are necessary. These include spreading roots to obtain water; ability to survive either in or out of the water; ability to withstand salt spray; ability to grow quickly; ability to grow through sand.
2. b.
3. Some reasons are: the basement would flood, water would wash out the foundation, blowing wind and sand would damage it, wood siding and metal fixtures would suffer from water and salt damage.
4. a-2; b-4; c-1, 2; d-1, 3.
5. a, c, d.

Beaches, Dunes, and Barrier Islands

Activity 2

Activity Review

Name: _____

1. List four adaptations necessary for plants to survive on a beach, dune, or barrier island.

- a. _____
- b. _____
- c. _____
- d. _____

2. Choose the correct phrase to complete this sentence: A hard shell is useful to a clam because _____

- a. it is heavy and keeps the clam from moving.
- b. it makes it more difficult for other animals to eat the clam.
- c. it helps a clam tell one kind of clam from another.

3. List three reasons why it would not be wise to build a typical family house on a beach.

- a. _____
- b. _____
- c. _____

4. Match the specialized feature with the way or ways it enables the animal to survive (an adaptation may serve more than one purpose).

- | | |
|--|--|
| _____ a. A curlew's long, slender bill | 1. Provides protection from predators. |
| _____ b. Long legs of a plover | 2. Used in food gathering. |
| _____ c. Claws of a crab | 3. Serves to cope with moving sand. |
| _____ d. Shell of a mussel | 4. Allows organism to move in shallow water. |

5. Which of the following items found on a beach, dune, or barrier island would best be able to withstand a major coastal storm? (Circle the correct letters.)

- a. A mussel
- b. A bridge
- c. Beachgrass
- d. A burrowing worm
- e. A summer cottage

Beaches, Dunes, and Barrier Islands

Activity 3

Seashore Survey



Organization

Who: Entire class, pairs of students

Where: Beach, dune, barrier island, and the classroom

When: Any time of year, particularly when the beach is likely to be crowded

Time: Two hour field trip, two hours in the classroom

Safety: a. Students should not enter the water while at the beach. b. Arrange for adequate supervision (one adult per ten students). c. Take proper precautions against sunburn.

Purpose

In this Activity, students will explore human uses of beach, dune, and barrier island habitats. Using survey Data Sheets, students will gather and compile information from people about how they use the area, what they value about it, and what they perceive to be its problems.

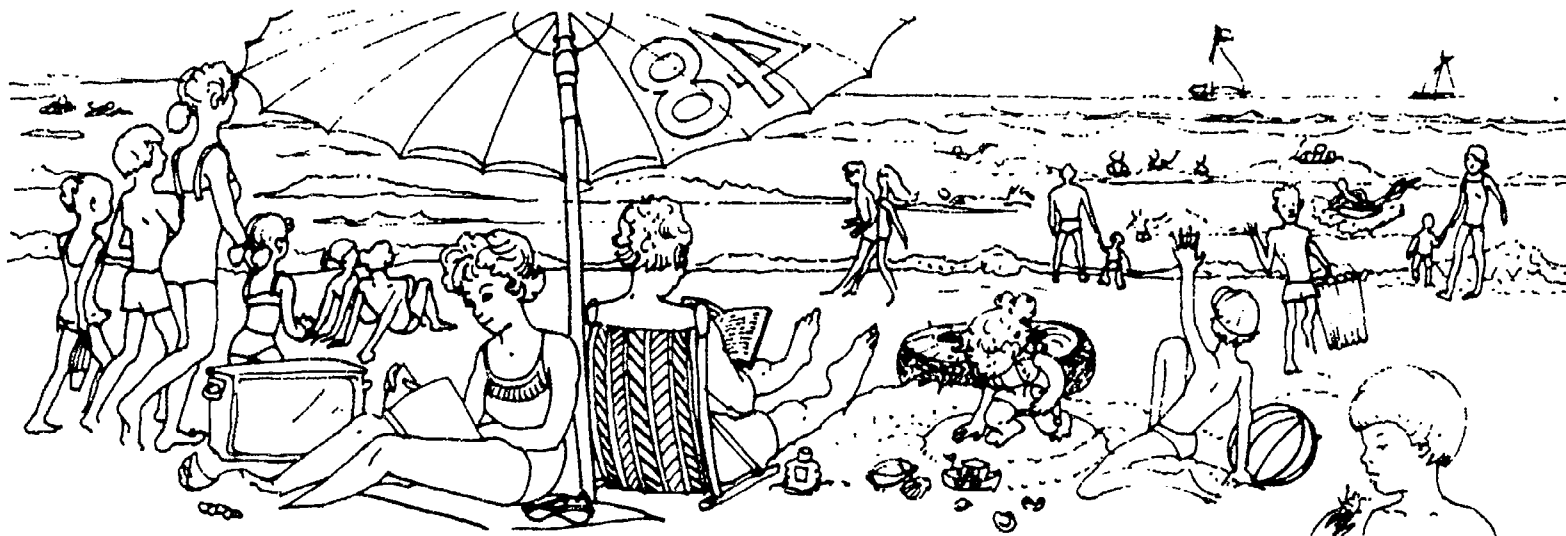
Learning Outcomes

After completing this Activity, students will be able to:

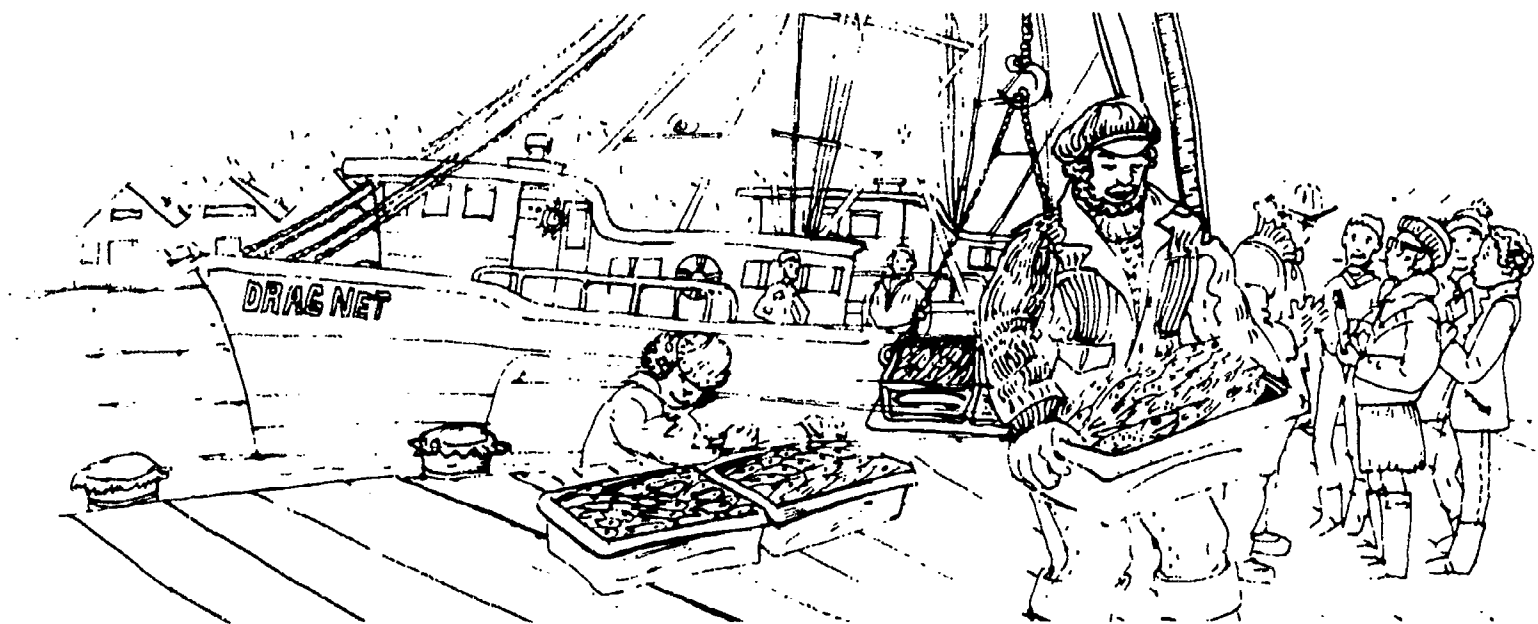
- A. List three positive and negative aspects of beach development.
- B. Match beach development to the various needs of people who use the beach.
- C. Prepare a management plan including students' recommendations for beach use and protection.

Materials: For Each Student

- Data Sheets
- Clipboard (Masonite or stiff cardboard with a paper clip or binder clip)
- Pencil



Recreational use



Commercial use

Directions

1. Begin by asking your students to describe ways that beaches, dunes, and barrier islands are used. List all of these on the board.
2. Ask the class to separate the uses into categories including recreational, commercial, and residential. Ask your students which of these is most important to them. Have them consider how their opinions might be different if they owned land or a fishing boat at the beach.
3. Tell your students that they will be visiting a beach to conduct a survey of the users. Discuss what a survey is and how it serves to find out people's opinions, likes, and dislikes about something.

4. Discuss the Data Sheets with your students. Have them practice interviewing each other so they understand both the form and how to phrase the questions without indicating the answer they want to hear. To further develop this, have them rephrase some of the questions so the questions show biases and prejudices.
5. At the beach, give pairs of students four or five Data Sheets to complete. Have the pairs take turns asking questions and recording answers. Remind them of the simple courtesies and precautions necessary when talking with strangers. Stress also the fragile nature of dune vegetation and wildlife.

6. Assign each group a specific section of the beach to canvass. In this way, supervision of groups will be easier and duplication of interviewees will be lessened.
7. After they have finished surveying, have students record their own feelings and impressions of the habitat they have been investigating. Include these in the data gathered.
8. The students will now compile the data they collected to see how the beach is used, its perceived problems and benefits, suggestions for improvement, and a little information about the users. Discuss their findings. Have students note relationships between beach users and individual perceptions of beach problems.



Residential use

9. After the survey discussion, have the class as a whole discuss how the beach should be used in the future. Generate several lists on the board. These lists should be of varied uses of a beach; the problems and conflicts between uses; the things people like about the beach; the things people dislike about the beach. Students should next determine the "common denominators" of each of these lists—what are the most common perceptions? Based on this, what should be done to the beach to allow for the continuation of the most-liked features, the prevention of the least-liked, and adjustments for those pursuits enjoyed by the most people? Bring out that different users have different needs and that these needs sometimes conflict.

10. Have each student prepare a report on how the beach studied should be used. This report will be based on class discussion and survey findings. Students may wish to use diagrams, maps, and charts.

Followup

Prepare one beach use plan for the class and write a newspaper article explaining the class plan. Submit the article with accompanying drawings to the local newspaper or school paper.

Activity Review Answers

1. Possible answers are fishing, sunbathing, collecting shells, birdwatching, running, and treasure hunting.
2. **False**—A survey should also find out what they like so that those factors can be included in the outcome (plan).
3. Since this question addresses student values, there is no wrong answer. In terms of accommodating all parties, **c** and **d** are the best answers. Choice **d** would result in more pressure on the public areas and might eventually result in the hastened deterioration of those areas.
4. The reasons why conflicts exist are many. Private residences may block access to the beach and prevent recreation. Commercial operations may pollute the air or water and produce unpleasant noise. Homes can also disrupt the deposition of sand on the beach, causing beaches to shrink. Recreational users may vandalize or leave litter on private property.
5. **a-3; b-2; c-4; d-1.**

For fun, have your students write more roles and responses to show that perception of the problem depends on how it affects you.



Beaches, Dunes, and Barrier Islands

Activity 3

Activity Review

Name: 

1. List four ways a beach can be used for recreation.

- a. _____
- b. _____
- c. _____
- d. _____

2. When taking a survey, you should only talk to people about what they don't like so you can find out what the problems are. **True or False?**

3. A new section of the coast is being developed. The area has good beaches and a nice view. What do you think would be the best management plan for a beach area that is popular both as a place to live and as a place to visit?

- a. Keep the area public so anyone can use it.
- b. Allow home-owners to have the beach all to themselves since they want privacy.
- c. Allow houses to be built but keep the beach itself public so that people can use the shore.
- d. Alternate private homes with public beaches so that both home-owners and the public can use the shore.

Explain your answer.

4. Choose two of the activities you gave in #1 and explain if they would conflict with commercial and residential uses. Explain why they are or are not conflicting uses.

- a. _____

- b. _____

5. There is a change in the temperature of the offshore current. It has gone from pleasant and warm to very cold. With this new cold water, great numbers of a tasty kind of fish, the Chop-Chop Fish, have arrived. Unfortunately, the Chop-Chop, while delicious, has a short life span and the beach becomes littered with dead fish.

Given these facts, match the person with their views on this.

- ___ a. Operator of a fishing company
- ___ b. Seaside hotel owner
- ___ c. Someone there for a day of summer vacation
- ___ d. Beach front home-owner

- 1. "Darn those Chop-Chop Fish! They taste good, but they sure do clutter up my beach. Oh well, maybe I can use them to fertilize the plants in my garden."
- 2. "What am I going to do? People are already complaining about the smell and the cold water. Pretty soon they'll leave and tell their friends not to come here!"
- 3. "Boy, I hope my boat is big enough to catch a lot of these. And think about the money I'll be able to make!"
- 4. "This is terrible—cold water and dead fish. I'm glad I'm getting out of here soon."

**Beaches,
Dunes, and
Barrier
Islands
Transect Study**

Activity 1

Data Sheet

Name:

Distance between sampling points _____

	Example	SAMPLE POINT 1	SAMPLE POINT 2
A. Location—water's edge, low tidemark, intertidal zone, above high tide, dunes	water's edge		
B. Plants and wildlife observed—types, names, numbers (many, some, few, none)	none		
C. Ghost crab/beach heath observations—many, some few, none (Count crab holes within a half-meter of the sampling point.)	2 crab burrows—few		
D. Evidence that people use the area	foot-prints, paper		

**Beaches,
Dunes, and
Barrier
Islands
Transect Study**

Activity 1

Data Sheet

Name:



SAMPLE POINT 3

SAMPLE POINT 4

SAMPLE POINT 5

A. Location

B. Plants and wildlife

**C. Ghost crab/beach
heath**

D. People

**Additional observations
on sand, waves, tides,
sand movement and
so on.**

PLANT OR ANIMAL

Here is a list of questions to consider when judging your classmates' creations.

- 1. Food**—If it is an animal, what does it eat? Where and how does it find its food?
- 2. Growth**—If it is a plant, how does it grow and spread? Seeds? Roots? Underground stems or runners?
- 3. Moisture**—How does it obtain fresh water to replace the moisture lost through evaporation, etc.?
- 4. Shelter**—Where does it live? How is it protected from wind, water, sun, and moving sand? What are its special features?
- 5. Protection**—What might want to eat it? How does it avoid this? Can it fly? Swim? Run away? Does it have thorns, claws, or a shell? Does its color protect it? What other problems must it face? Weather? Waves? Moving sand and tides? How does it avoid these hazards?
- 6. Summary**—Is this plant or animal well adapted to live on the beach? Why or why not?

Count 1 point for each condition met in overall plant/animal adaptation. (E.g., if a "created animal" has a way of getting food, protecting itself, and finding shelter, but cannot get water, score "3".) Perfect scores ("5") are earned only if all conditions are met.

Adaptation Evaluation Score

Creation #1	Creation #2	Creation #3	Creation #4	Creation #5
Creation #6	Creation #7	Creation #8	Creation #9	Creation #10

Here is a list of questions to consider when building on a beach.

- 1. Foundation**—What kind of foundation does the building have? How do salt water, wind, sand, and storms affect it?
- 2. Main Building**—What is the shape and size of the building? Is it resistant to wind, sun, water, blowing sand, and salt spray?
- 3. Impacts**—How will the building affect the plants and wildlife of the area? How might negative effects be reduced?
- 4. Building Materials**—Of what materials is the building constructed? Will sand, erosion, salt, water, and wind affect these?
- 5. Location**—How close is the building to the dunes? The ocean? The incoming tide? What effect will this have on the building?
- 6. Summary**—Is this building well-adapted to the beach? Why or why not?

Count 1 point for each condition met. If all five are met, building receives perfect score ("5").

Adaptation Evaluation Score

Building #1	Building #2	Building #3	Building #4	Building #5
Building #6	Building #7	Building #8	Building #9	Building #10

**Beaches,
Dunes, and
Barrier
Islands****Activity 3****Data Sheet**

Hello. My name is _____
and I'm from _____

We are studying the beach as part of a class project and are trying to gather information about how people feel about the beach. Would you mind answering a few questions for me? I will read the questions and a list of possible answers, and you tell me which one would be your answer.

1. Are you:

- _____ a. At the beach all the time?
- _____ b. Here for part of the year?
- _____ c. A yearly visitor (do you come here every year for a few weeks)?
- _____ d. Here for the first time?

2. Is the beach or ocean a source of income for you or your family?

- _____ Yes
- _____ No

3. Why do you use the beach?

- _____ a. Place to earn money
- _____ b. Place to relax
- _____ c. Place to live

4. Has the beach changed during the time (years) you have been coming here?

- _____ Yes
- _____ No

5. What kind of changes have you seen?

- _____ a. More people
- _____ b. Less wildlife
- _____ c. More development
- _____ d. Less open space
- _____ e. More commercial fishing
- _____ f. Less sand
- _____ g. Other _____

6. Have these changes improved the beach for you?

- _____ Yes
- _____ No

7. Which of these phrases best describes how you feel about the beach?

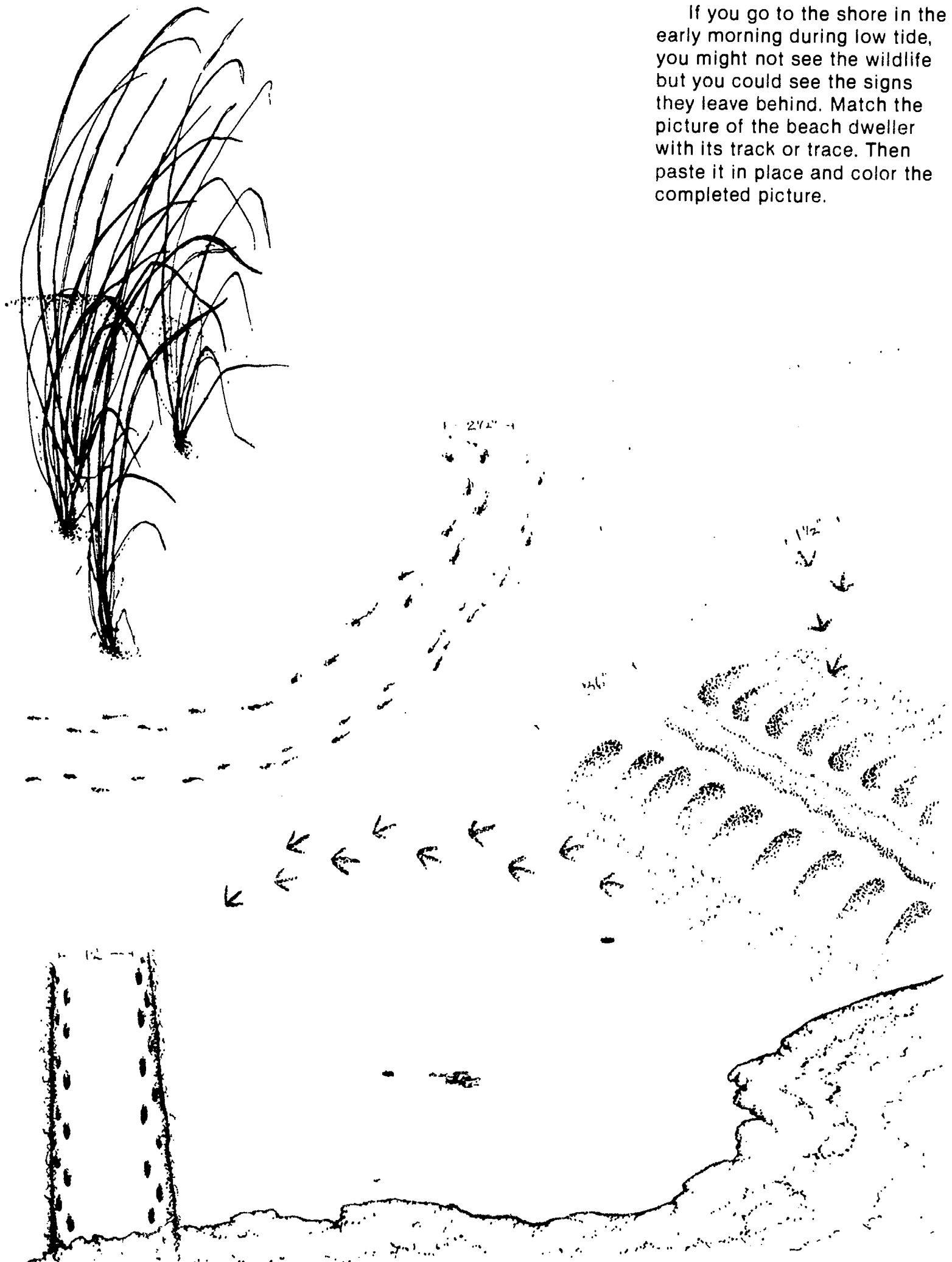
- _____ a. Very nice, no problems
- _____ b. Nice, with a few minor problems
- _____ c. There are problems, but it is also pleasing
- _____ d. Bad, with a few pleasing aspects
- _____ e. Very bad, not pleasing in any way

8. What problems do you find with the beach?

9. What do you like best about the beach?

(Space to write your own questions or comments)

If you go to the shore in the early morning during low tide, you might not see the wildlife but you could see the signs they leave behind. Match the picture of the beach dweller with its track or trace. Then paste it in place and color the completed picture.



A



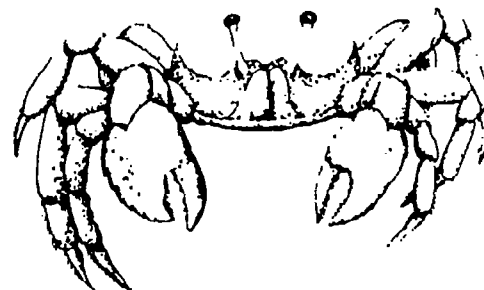
Why say clam-up when I dig down?
Under the sand is where I'm found.

B



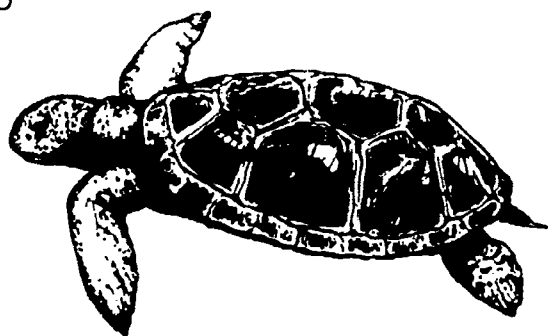
On the water's edge I pick and feed.
Tracks I leave and food I need.

C



Like a spirit at night I prowl the dark.
At dawn I hide but leave my mark.

D



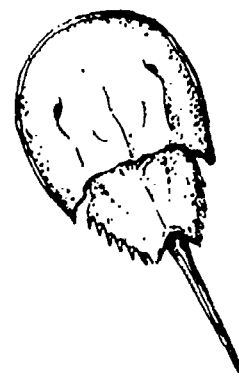
With my house on my back I travel the sea,
Till it's time to lay eggs when on land I must be.

E



People who fish look for my
cousins on land,
But I am happiest under
the sand.

F



Odd to look at and not very tasty,
I'm found on the beach and never get
hasty.

Here are the names of the animals shown. Match each with its picture.

___ Lugworm
___ Sandpiper
___ Green turtle

___ Ghost crab
___ Clam
___ Horseshoe crab